irradiating a sample with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

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monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

[processing] comparing the first and second portions of the modulated **[return radiation]** fluorescence to determine a modulation characteristic of the sample.

7
~~12~~. (Amended) The method of claim 1, wherein monitoring of the modulated **[return radiation]** fluorescence comprises:

collecting a portion of the modulated **[return radiation]** fluorescence; and

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determining the intensity of the collected portion of modulated **[return radiation]** fluorescence.

8 7
~~13~~. (Amended) The method of claim ~~12~~, wherein the first portion of the modulated **[return radiation]** fluorescence is collected with a first waveguide and the second portion of the modulated **[return radiation]** fluorescence is collected with a second waveguide.

13
~~18~~. (Amended) The method of claim 1, wherein irradiating the sample

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comprises directing radiation to the sample using a first waveguide and wherein the **[return radiation]** fluorescence is monitored using the first waveguide.

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14 7

19. (Amended) The method of claim 12, wherein the intensity of the collected portion of the **[return radiation]** fluorescence is determined with a sensor.

15 7

20. (Amended) The method of claim 12, wherein the intensity of the first portion of the modulated **[return radiation]** fluorescence is determined with a sensor.

16 7

21. (Amended) The method of claim 12, wherein the intensity of the second portion of the modulated **[return radiation]** fluorescence is determined with a sensor.

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17 7

22. (Amended) The method of claim 12, wherein the intensity of the first portion of the modulated **[return radiation]** fluorescence is determined with a first sensor and the intensity of the second portion of the modulated **[return radiation]** fluorescence is determined with a second sensor.

18 7

23. (Amended) The method of claim 12, wherein the first and second portions of the modulated **[return radiation]** fluorescence are measured consecutively.

19 7

24. (Amended) The method of claim 12, wherein the first and second portions of the modulated **[return radiation]** fluorescence are measured simultaneously.

38

39. (Amended) A spectroscopic method for determining the oxygenation of a biological material, comprising:

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irradiating a sample of a biological material with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by attenuation of the sample;

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monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

[processing] comparing the first and second portions of the modulated **[return radiation]** fluorescence to determine the attenuation of the sample;

determining oxygenation of the sample using the attenuation of the sample.

40

41. (Amended) A spectroscopic method for determining the concentration of hemoglobin in a biological material, comprising:

irradiating a sample of biological material with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by attenuation of the sample;

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monitoring a first portion of the **[modulate return radiation]** modulated fluorescence at a first distance from the sample;

monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

comparing the first and second portions of the modulated fluorescence to determine the attenuation of the sample;

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B5 determining the concentration of hemoglobin in the sample using the attenuation of the sample.

42

48. (Amended) A method for determining a physiological characteristic of a biological material, comprising:

irradiating a sample of biological material with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

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monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

[processing] comparing the first and second portions of the modulated **[return radiation]** fluorescence, using a predictive model, to determine a physiological characteristic of the sample.

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50. (Amended) A method for determining a physiological characteristic of biological material, comprising:

irradiating a sample of biological material with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

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monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

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monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

B7 **[processing]** comparing the first and second portions of the modulated **[return radiation]** fluorescence to determine a modulation characteristic of the sample;

processing the modulation characteristic using a predictive model to determine a physiological characteristic of the sample.

46

52. (Twice Amended) Apparatus for analyzing a sample, comprising:

a source adapted to emit radiation that is directed at a sample to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

a first sensor adapted to monitor the **[return radiation]** fluorescence at a first distance from the sample and generate a first signal indicative of the intensity of the

B8 **[return radiation]** fluorescence;

a second sensor adapted to monitor the **[return radiation]** fluorescence at a second distance from the sample and generate a second signal indicative of the intensity of the **[return radiation]** fluorescence, the second distance being different from the first distance; and

a processor associated with the first sensor and the second sensor and adapted to **[process]** compare the first and second signals to determine a modulation characteristic of the sample.

48

53. (Amended) Apparatus for analyzing a sample, comprising:

a source adapted to emit radiation that is directed at a sample volume in a sample to produce **[return light]** fluorescence from the sample, such **[return light]**

fluorescence including modulated **[return light]** fluorescence resulting from modulation by the sample;

a first sensor adapted to monitor the **[return light]** fluorescence at a first distance from the sample volume and generate a first signal indicative of the intensity of the **[return light]** fluorescence;

a second sensor adapted to monitor the **[return light]** fluorescence at a second distance from the sample volume and generate a second signal indicative of the intensity of the **[return light]** fluorescence, the second distance being different from the first distance;

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a processor associated with the first sensor and the second sensor and adapted to **[process]** compare the first and second signals to determine a modulation characteristic of the sample.

49

54. (Amended) Apparatus for determining a modulation characteristic of a biological material, comprising:

a source adapted to emit excitation light;

a first waveguide disposed a first distance from the sample adapted to transmit the excitation light from the light source to the biological material to cause the biological material to produce **[return light]** fluorescence and adapted to collect a first portion of the **[return light]** fluorescence**[, such return light including fluorescence of the biological material]**;

a first sensor, associated with the first waveguide, adapted to measure the intensity of the first portion of the **[return light]** fluorescence and generate a first signal indicative of the intensity of the first portion of the **[return light]** fluorescence;

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a second waveguide disposed at a second distance from the sample adapted to collect a second portion of the **[return light]** fluorescence, the second distance being different from the first distance;

a second sensor, associated with the second waveguide, adapted to measure the intensity of the second portion of the **[return light]** fluorescence and generate a second signal indicative of the intensity of the second portion of the **[return light]** fluorescence;

a processor adapted to **[process]** compare the first and second signals to determine a modulation characteristic of the biological material.

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B8 55. (Amended) Apparatus for analyzing a sample, comprising:

a source adapted to emit radiation that is directed at a sample volume in a sample to produce **[return light]** fluorescence from the sample, such **[return light]** fluorescence including modulated **[return light]** fluorescence resulting from modulation by the sample;

a first sensor, displaced by a first distance from the sample volume adapted to monitor the **[return light]** fluorescence and generate a first signal indicative of the intensity of the **[return light]** fluorescence; and

a second sensor, displaced by a second distance from the sample volume adapted to monitor the **[return light]** fluorescence and generate a second signal indicative of the intensity of **[return light]** fluorescence, the second distance being different from the first distance;

a processor associated with the first sensor and the second sensor and adapted to **[process]** compare the first and second signals to determine a physiological property of the sample.

51

56. (Twice Amended) Apparatus for determining a physiological property of biological material, comprising:

a source adapted to emit excitation light;

a first waveguide disposed a first distance from the sample adapted to transmit the excitation light from the light source to the biological material to cause the biological material to produce **[return light]** fluorescence and adapted to collect a first portion of the **[return light]** fluorescence**[, such return light including fluorescence of the biological material]**;

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a first sensor, associated with the first waveguide, for measuring the intensity of the first portion of the **[return light]** fluorescence and generating a first signal representative of the intensity of the first portion;

a second waveguide disposed at a second distance from the sample adapted to collect a second portion of the **[return light]** fluorescence, the second distance being different from the first distance;

a second sensor, associated with the first waveguide, for measuring the intensity of the second portion of the**[return light]** fluorescence and generating a second signal representative of the intensity of the second portion;

a processor adapted to **[process]** compare the first and second signals to determine a physiological property of the biological material.

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57. (Amended) The apparatus of claim 52, wherein fiber optics transmit the [return radiation] fluorescence to the sensors.

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59. (Amended) A spectroscopic method of analyzing a sample, comprising:

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irradiating a sample with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;

[processing] comparing the first and second portions of the modulated **[return radiation]** fluorescence to determine a modulation characteristic of the sample;

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wherein the sample is biological material;

wherein the method further includes determining a physiological property of the tissue using the modulation characteristic; and

wherein the physiological property of the tissue is ischemia.

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60. (Amended) A method for determining a physiological characteristic of a biological material, comprising:

irradiating a sample of a biological material with radiation to produce **[return radiation]** fluorescence from the sample, wherein the **[return radiation]** fluorescence is modulated by the sample;

monitoring a first portion of the modulated **[return radiation]** fluorescence at a first distance from the sample;

monitoring a second portion of the modulated **[return radiation]** fluorescence at a second distance from the sample, the second distance being different from the first distance;